

Structural bolts per ASTM A325 are made to the dimensional requirements of ANSI/ASME B18.2.6 and feature a larger width across the flats (heavy hex) than standard grade 5 or 8 hex cap screws would have. Structural bolts also have a shorter thread length than is found on grade 5 and grade 8 bolts and screws.

A325 bolts are the most commonly specified structural bolt grade for use in the construction of buildings, warehouses and bridges. The A325 strength level is very similar to the SAE grade 5 strength level.



Marking: A325 and manufactures ID

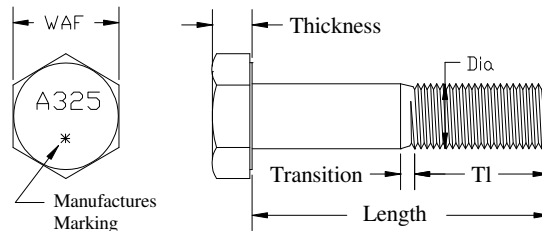
**Material:** Medium Carbon (or Alloy) Steel

<b>Carbon</b>	<b>Manganese</b>	<b>Phosphorus</b>	<b>Sulfur</b>
.30 to .55	.060 min	.035 max	.040 max

<b>Tensile Strength:</b>	1/4 to 1" Dia	120,000 psi min
	1 1/8 to 1 1/2" Dia	105,000 psi min

**Percent Elongation:** 14% min

<b>Hardness (Core):</b>	1/4 to 1" Dia	Rc 25 / 34
	1 1/8 to 1 1/2" Dia	Rc 19 / 30



Nominal Size	WAF	Head Thickness	Thread Length	Thread Transitional
1/2	7/8	5/16	1.0	.19
5/8	1 1/16	25/64	1.25	.22
3/4	1 1/4	15/32	1.38	.25
7/8	1 7/16	35/64	1.50	.28
1	1 5/8	39/64	1.75	.31
1 1/8	1 13/16	11/16	2.0	.34
1 1/4	2	25/32	2.0	.38
1 3/8	2 3/16	27/32	2.25	.44
1 1/2	2 3/8	15/16	2.25	.44

Lengths that are fully threaded

Nominal Size	Lengths up to
1/2"	1 1/4
5/8	1 1/2
3/4	1 3/4
7/8	2
1	2 1/4
1 1/8	2 3/4
1 1/4	2 3/4
1 3/8	3
1 1/2	3

# Tension Control Bolt

## Round Head Assemblies



Earnest Machine Products line of tension control bolts (also know as twist-off bolts) are manufactured with the round (also called button) head design and are available in two strength levels (A325 and A490).

Tension control bolts are supplied as an assembly and come with a heavy hex structural nut and structural flat washer.

### A325 Assembly

#### Tension Control Bolt Set (Twist Off Type) Bolt and Nut

- Round Head Bolt, ASTM F1852 (Type 1 steel), Plain
- Heavy Hex Nut, ASTM A563 Gr.DH, Plain
- Structural Washer, ASTM F436, Plain

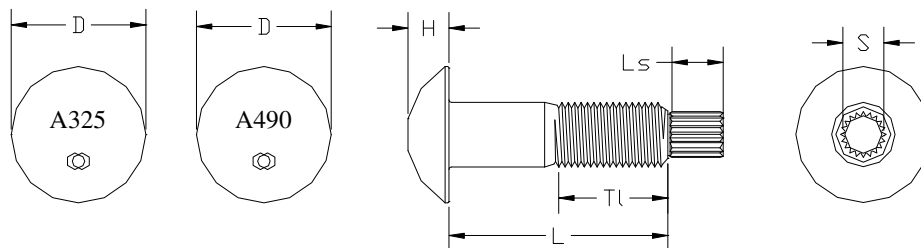
### A490 Assembly

#### Tension Control Bolt Set (Twist Off Type) Bolt and Nut

- Round Head Bolt, ASTM F2280 (Type 1 alloy steel), Plain
- Heavy Hex Nut, ASTM A563 Gr.DH, Plain
- Structural Washer, ASTM F436, Plain

### Strength Levels

	Bolt Grade	TC Bolt Grade	Nut Grade	Corresponding SAE Grade	Tensile Strength
Medium Strength	A325	F1852	A563 Gr DH	(Grade 5)	120,000 psi / 105,000 psi
High Strength	A490	F2280	A563 Gr DH	(Grade 8)	150,000 psi

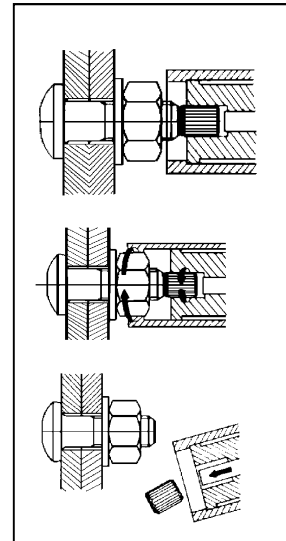


Size	Head Diameter D max	Head Height H max	Spline Length Ls ref	Spline WAF S ref	Thread Length
1/2	1.126	.232	.50	.32	1.00
5/8	1.313	.403	.60	.43	1.25
3/4	1.580	.483	.65	.53	1.38
7/8	1.880	.563	.72	.61	1.50
1	2.158	.627	.80	.70	1.75
1 1/8	2.375	.718	.90	.80	2.00

**Packaging** Metal containers for protection against weather.

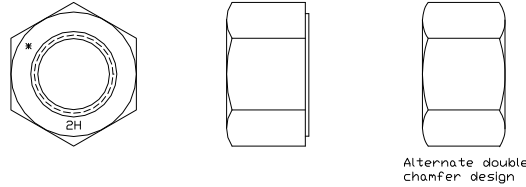


Must be installed using special installation tool (or gun)



## Heavy Hex Nuts

ASTM A194 Grade 2H



Earnest Machine Products offers Heavy Hex Nuts in sizes 1/4" to 5 1/2" manufactured to the Grade 2H strength level per ASTM A194.

**1.) Manufacture:** These hex nuts are manufactured in accordance with the latest revision of the following industry standards:

- ASME B18.2.2      Dimensional Requirements
- ASTM A194        Material and Physical Properties
- ASME B1.1        Thread Requirements

**2.) Threads:** Threads are made to the requirements of ANSI B1.1 Unified Threads, 2B Fit. Thread acceptance based on ANSI B1.3, System 21

**3.) Material and Physical Properties:** These nuts are made from grade 2H material as specified by ASTM A194.

**Proof Load:** 175,000 psi min

**Chemical Composition Requirements**

Carbon (C)	Manganese (Mn)	Phosphorus (P)	Sulfur (S)	Silicon (Si)
Min	Max	Max	Max	Max
0.40	1.00	0.04	0.05	0.40

**Hardness**

Nominal Nut Size	Rockwell Hardness
1/4 thru 1 1/2	Rc 24 – 35
1 5/8 thru 5 1/2	Rb 95 – Rc 35

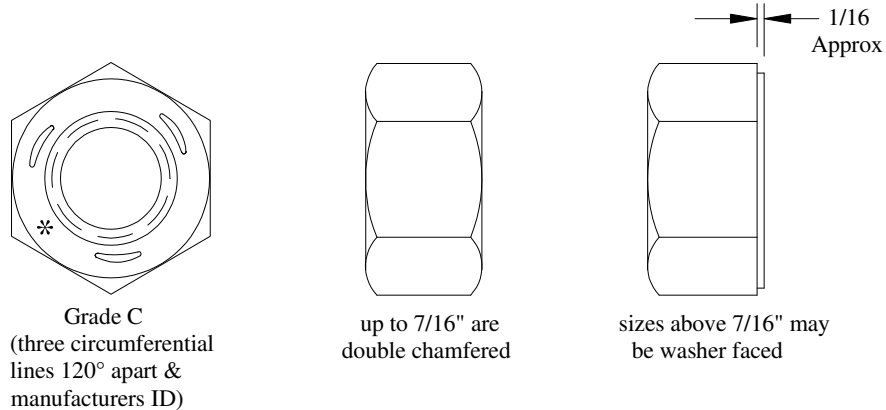
**4.) Dimensions:** heavy hex nuts are made to the dimensions specified in ASME B18.2.2

Size	Width Across Flats	Thickness	Size	Width Across Flats	Thickness
1/4	1/2	15/64	1 3/4	2 3/4	1 23/32
5/16	9/16	19/64	1 7/8	2 15/16	1 27/32
3/8	11/16	23/64	2	3 1/8	1 31/32
7/16	3/4	27/64	2 1/4	3 1/2	2 13/64
1/2	7/8	31/64	2 1/2	3 7/8	2 29/64
9/16	15/16	35/64	2 3/4	4 1/4	2 45/64
5/8	1 1/16	39/64	3	4 5/8	2 61/64
3/4	1 1/4	47/64	3 1/4	5	3 3/16
7/8	1 7/16	55/64	3 1/2	5 3/8	3 7/16
1	1 5/8	63/64	3 3/4	5 3/4	3 11/16
1 1/8	1 13/16	1 7/64	4	6 1/8	3 15/16
1 1/4	2	1 7/32	4 1/4	6 1/2	4 3/16
1 3/8	2 3/16	1 11/32	4 1/2	6 7/8	4 7/16
1 1/2	2 3/8	1 15/32	5	7 5/8	4 31/32
1 5/8	2 9/16	1 19/32	5 1/2	8 3/8	5 7/16

## Heavy Hex Nuts

ASTM A593 Grade C

Earnest Machine Products line of Grade C heavy hex nuts are made to the dimensional requirements of ANSI B18.2.2 for Heavy Hex Nuts and the material and strength requirements of ASTM A563.



### Grade C

The physical and material properties are per the requirements of ASTM A563 for Grade C strength level.

**Material:** Steel with the following minimum chemical composition requirements (per Heat of steel used)

Carbon	Manganese	Phosphorus	Sulfur
.55 max	(not specified)	.12 max	.15 max

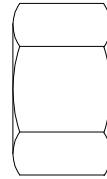
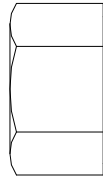
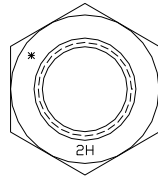
**Proof Load Strength:**

Sizes	Proof Load
1/4 to 4": Coarse (UNC) Thread	144,000 psi

**Hardness:** Rb 78 to Rc 38

# Heavy Hex Structural Nuts

## Hot Dip Galvanized and Waxed



Alternate double chamfer design

Earnest Machine Products offers heavy hex nuts that are hot dip galvanized (zinc) coated and lubricated with a wax. These nuts are available in Grade 2H (per ASTM A194) in sizes from 1/2" to 2 1/2" and Grade DH (per ASTM A563) in sizes 1/2" to 1 1/2".

The hot dip galvanized is applied to the requirements of ASTM A153 (ASTM F2329) and are tapped oversized to the thread requirements listed in ASTM A563. Tapping the threads oversized ensures proper assembly with hot dip galvanized structural bolts.

The wax is designed to provide torque tension performance for lubricated assemblies as defined by AISC guidelines. The wax is applied on top of the hot dip galvanizing and has a blue dye added to clearly identify them as "lubricated" nuts (per requirements of ASTM A563).

Material and Physical Properties:	Proof Load:	Grade 2H	Grade DH
		(tapped oversized) 150,000 psi min	(tapped oversized) 150,000 psi min
	<b>Material:</b>	Medium Carbon Steel	Medium Carbon Steel
	<b>Hardness:</b> 1/2" to 1-1/2" 1-5/8" to 4"	Rc 24 to Rc 35 Rb 95 to Rc 35	Rc 24 to Rc 38 Rc 24 to Rc 38

**Dimensions:** Heavy hex structural nuts per ASME B18.2.6 are made to the dimensions specified in ASME B18.2.2

Size	Width Across Flats	Thickness	Overtapping Allowance
1/2 – 13	7/8	31/64	.018
5/8 – 11	1-1/16	39/64	.020
3/4 – 10	1-1/4	47/64	.020
7/8 – 9	1-7/16	55/64	.022
1 – 8	1-5/8	63/64	.024
1 1/8 – 7	1-13/16	1-7/64	.024
1 1/4 – 7	2	1-7/32	.024
1 3/8 – 6	2-3/16	1-11/32	.027
1 1/2 – 6	2-3/8	1-15/32	.027
1 3/4 – 5	2-3/4	1-23/32	.050
2 – 4 1/2	3-1/8	1-31/32	.050
2 1/4 – 4 1/2	3-1/2	2-13/64	.050
2 1/2 - 4	3-7/8	2-29/64	.050

Note that hot dip galvanized nuts can be sold with and without a lubricant applied to them. Earnest line of hot dip galvanized nuts are lubricated with a wax that has a blue dye added to clearly mark the nuts as lubricated. The torque that is used to assemble these nuts should be based on the designers or applications requirements. The torques listed below are based on testing requirements.

Size	Torque when used with A325 Bolts	Torque when used with A490 Bolts
1/2	60 ft-lb	70 ft-lb
5/8	120 ft-lb	150 ft-lb
3/4	200 ft-lb	250 ft-lb
7/8	350 ft-lb	450 ft-lb
1	500 ft-lb	650 ft-lb
1 1/8	650 ft-lb	900 ft-lb
1 1/4	900 ft-lb	1300 ft-lb
1 3/8	1150 ft-lb	1700 ft-lb
1 1/2	1550 ft-lb	2200 ft-lb

# F436 Structural Flat Washer

Earnest Machine Products line of F436 Structural Washers are made to the dimensions and physical properties as specified by ASTM F439 for Round Structural Washers.

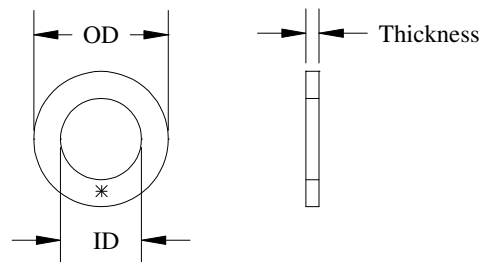
The material and heat treatment are per the requirements specified by ASTM F436 for Type 1 steel

Material – Medium Carbon Steel

Hardness – Up to 1 1/2” Through Hardened to Rc 38/45

Sizes above 1 1/2” may be case hardened.

Dimensions are per ASTM F436. Washers will have a vendor’s marking.



Size (Bolt Dia)	Inside Diameter			Outside Diameter			Thickness	
	Nom	Max	Min	Nom	Max	Min	Max	Min
<b>1/2</b>	17/32	.531	.500	1 1/16	1.094	1.031	.177	.097
<b>5/8</b>	11/16	.688	.657	1 5/16	1.344	1.281	.177	.122
<b>3/4</b>	13/16	.812	.781	1 15/32	1.500	1.438	.177	.122
<b>7/8</b>	15/16	.938	.907	1 3/4	1.781	1.719	.177	.136
<b>1</b>	1 1/8	1.125	1.094	2	2.031	1.969	.177	.136
<b>1 1/8</b>	1 1/4	1.250	1.219	2 1/4	2.281	2.219	.177	.136
<b>1 1/4</b>	1 3/8	1.375	1.344	2 1/2	2.531	2.469	.177	.136
<b>1 3/8</b>	1 1/2	1.500	1.468	2 3/4	2.781	2.719	.177	.136
<b>1 1/2</b>	1 5/8	1.625	1.594	3	3.031	2.969	.177	.136
<b>1 3/4</b>	1 7/8	1.875	1.812	3 3/8	3.438	3.312	.280	.178
<b>2</b>	2 1/8	2.125	2.062	3 3/4	3.812	3.688	.280	.178
<b>2 1/4</b>	2 3/8	2.375	2.312	4	4.062	3.938	.340	.240
<b>2 1/2</b>	2 5/8	2.625	2.562	4 1/2	4.562	4.438	.340	.240
<b>2 3/4</b>	2 7/8	2.875	2.812	5	5.062	4.938	.340	.240
<b>3</b>	3 1/8	3.125	3.062	5 1/2	5.562	5.438	.340	.240